



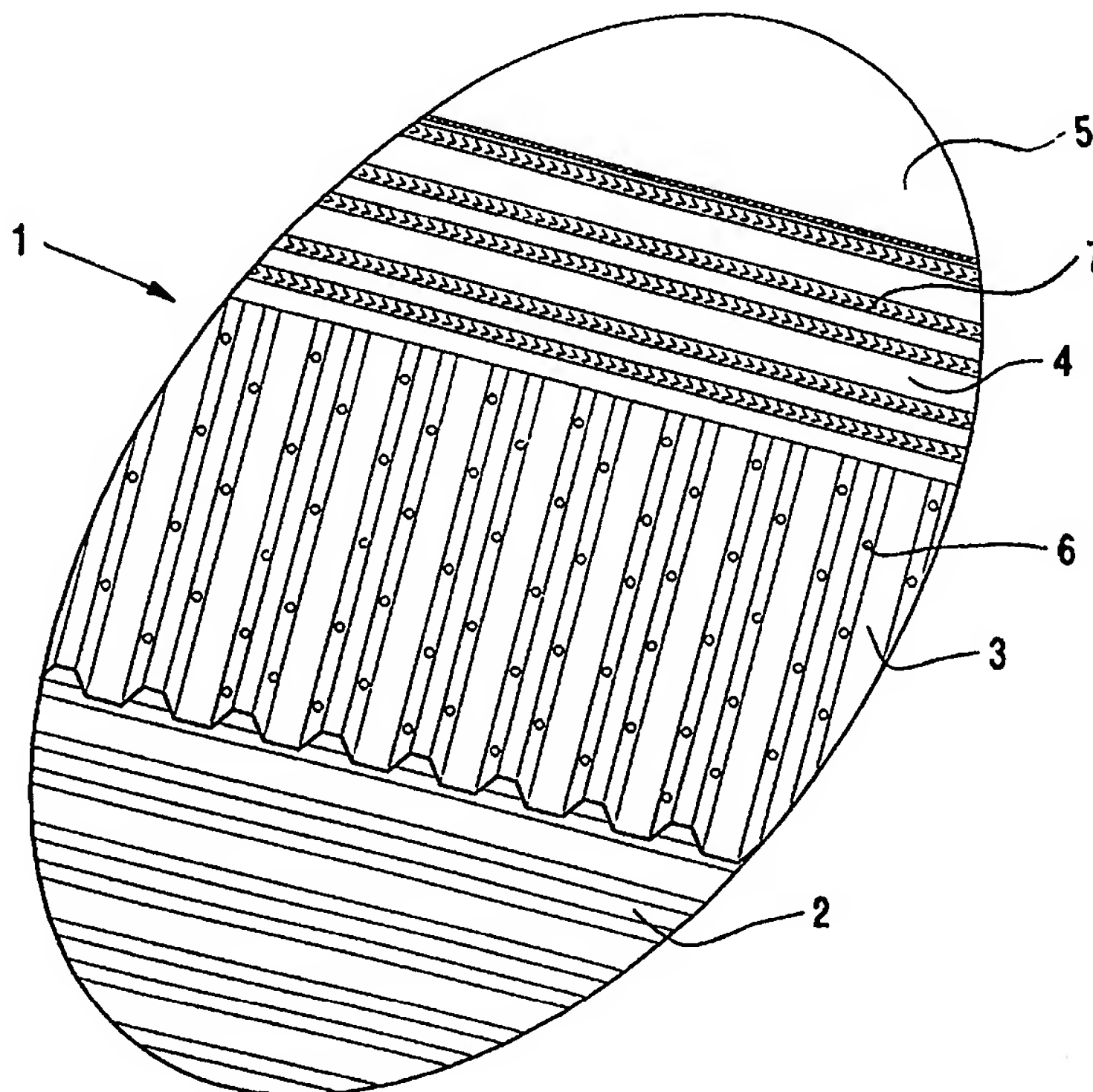
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : E04B 5/14, 5/48, F24D 5/10 // E01C 13/02	A1	(11) International Publication Number: WO 99/63179 (43) International Publication Date: 9 December 1999 (09.12.99)
(21) International Application Number: PCT/NO99/00162 (22) International Filing Date: 20 May 1999 (20.05.99) (30) Priority Data: 19982520 2 June 1998 (02.06.98) NO (71) Applicant (for all designated States except US): VØLSTAD ENERGY AS [NO/NO]; Bergenevn. 16, N-4355 Kvernaland (NO). (72) Inventor; and (75) Inventor/Applicant (for US only): VØLSTAD, Ove, Charles [NO/NO]; Bergenevn. 16, N-4355 Kvernaland (NO). (74) Agents: HÅMSØ, Borge et al.; Håmsø Patentbyrå ANS, P.O. Box 171, N-4302 Sandnes (NO).		(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i> <i>In English translation (filed in Norwegian).</i>

(54) Title: DEVICE FORMING A PARTITION BETWEEN STOREYS

(57) Abstract

The invention relates to a device by a constructional part (1) preferably extending between supporting parts (10, 11, 12) of a building or plant construction, and preferably forming a partition between storeys, such as a floor or deck. The constructional part (1) is self-supported, preferably of light-weight material and comprises a channel system for air, so that the constructional part (1) may provide heating and/or cooling of rooms in the building or plant construction, or may thaw snow and ice lying on the constructional part, respectively. The constructional part (1) is made up of at least three interconnected layers (2, 3, 4) of corrugated sheet material. The layers (2, 3, 4) are arranged at angles in relation to each other, in such a way that corrugations form a preferably right angle between themselves, so that the corrugations of the layers (2, 3, 4) form a channel system in the constructional part (1). A number of holes (6) are made in the intermediate layer (3). The holes (6) extend transversely to and preferably in a plane through the mid section of the corrugations, so that air at a temperature suitable for heating and/or cooling, or thawing, respectively, may be supplied and/or extracted in a controlled manner in the channel system formed. The corrugations of the upper layer (4) are advantageously filled with an additional cast (5) of light-weight material of good thermal conductivity to a level at least at the height of the corrugation ridges of the upper sheet layer (4).



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

DEVICE FORMING A PARTITION BETWEEN STOREYS

5 The invention relates to a device by a constructional part preferably extending between supporting parts of a building or plant construction, and preferably forming a partition between storeys, such as a floor or deck.

In known building and plant constructions the storey-
10 separating constructional part is normally of concrete. The constructional part usually extends between the supporting parts of the building or plant construction, and is either cemented *in situ* or is in the form of prefabricated elements. Work on such constructional parts of concrete is resource de-
15 manding in its own ways. The use of heavy material such as concrete in the partition between storeys, entails that the supporting parts must be increased in size. Besides, each storey must be provided with additional height of at least 30 cm to provide room for channels for the air normally used for
20 heating and/or cooling rooms in the building or plant con-

struction. All these things are cost-increasing conditions of known constructions.

Among persons skilled in the art, there is a certain scepticism towards the use of material other than concrete in e.g. storey-separating constructional parts. Said scepticism involves, among other things, doubt as to carrying capacity, durability, etc. Neither has there been any capability of utilising the partition between storeys for carrying for example air which is used for heating and cooling. The objections in this matter are that the carrying capacity will be weakened, that the constructional part cannot be used for heating and cooling in a suitable manner, etc.

Besides, it is well known that the work of clearing snow and ice results in great costs during construction, as well as during the subsequent operation and maintenance of the building and the plant construction.

An object of the present invention is to avoid, to the greatest possible degree, the above heavy, work-demanding and cost-increasing constructional parts in concrete. Other objects are to reduce the storey height by the use of freely suspended air channels being avoided. Likewise, it is desired to provide a more efficient means of removing snow and ice lying on the constructional part, for instance when it forms part of the roof of the building or plant, and which means may be used for thawing snow and ice while the building or plant construction is under construction.

This has been realised by means of the present device by a constructional part preferably extending between supporting parts of a building or plant construction, and preferably

forming a partition between storeys, such as a floor or a deck. The invention is characterized by the fact that the constructional part is self-supporting, preferably of lightweight material and comprises a channel system, so that the constructional part may be utilised for heating and/or cooling of rooms in the building or plant construction, or may thaw snow or ice lying on the constructional part, respectively. The constructional part is made up of at least three interconnected layers of corrugated sheet material. The layers are placed at angles in such a way that corrugations form a preferably right angle between themselves, so that the corrugations of the sheet layers form a channel system. The channels are interconnected by a number of holes having been made in the intermediate layer. The holes extend transversely to and preferably in one plane through the mid section of the layer, so that air at a temperature adjusted for heating and/or cooling and thawing, respectively, may be taken through the formed channel system in a controlled manner. Other advantageous features of the invention will appear from the following part of the specification and the dependent claims.

Referring to the set of figures, preferable non-limiting embodiments of the invention will be explained in further detail.

Fig. 1 shows schematically a view of the present constructional part, drawn so that the configuration shows;

Fig. 2 shows a schematic vertical section of for example a detached house in which the constructional part is used as a floor on the ground in the lowermost storey, and possibly in the roof of the detached house; and

Fig. 3 shows a schematic vertical section through a building of several storeys, in which the constructional part is used as a partition which forms floor and ceiling of the building.

According to the invention, the present constructional part 1 should preferably form a storey-separating part such as a floor or deck in a building or plant construction. The building or plant construction may be of different types, e.g. a detached house, a multi-storey building, a road bridge etc. The constructional part 1 which is self-supporting and of light-weight material extends between supporting parts 10, 11, 12 of the building or plant construction. In Fig. 2 it is shown in connection with an annular wall 10, while in Fig. 3 it extends between girders 11, 12. In Fig. 2 is shown that the constructional part may rest on layers of insulating material, e.g. Leca 8 and polystyrene 9. It will also be of advantage to insulate the constructional part 1 on its underside when it is used as a deck between storeys in the building or plant construction.

Moreover, the constructional part 1 comprises a channel system for air to be used for heating or cooling of rooms in the building or plant construction, or for thawing snow or ice lying on the constructional part 1, respectively. Said channel system which enables the constructional part to provide heating and/or cooling, and the self-supporting and light-weight properties of the constructional part 1 are provided by the constructional part 1 being made up of at least three interconnected layers 2, 3, 4 of corrugated sheet material. The layers 2, 3, 4 are placed at angles in such a way that the corrugations form a preferably right angle between themselves. The channels formed thereby, are made to communicate with each other by a number of holes 6 having been made in

the sheet walls between ridges and valleys of the intermediate sheet layer 3. The holes 6 extend transversely to and preferably in a plane through the mid section of the layer 3, so that air at the appropriate temperature may be carried
5 through the channel system in a controlled manner.

The layers 2, 3, 4 are connected to each other at contact points between corrugation valleys and ridges by means of popping, gluing, screwing, welding or similar. To ensure good temperature exchange, the corrugations of the upper layer 4
10 are filled with additional cast 5 of light-weight material of good thermal conductivity to a level at least at the height of the corrugation ridges. The walls of the corrugations in the part to be cast in, may with advantage have embossings 7
15 either projecting from or into the wall of the corrugation, so that the co-operation between sheet material and additional cast 5 is the best possible.

Air may be supplied and/or extracted from the constructional part 1 through at least one channel 14 in the supporting parts 10, 11, 12 of the building construction. Each channel
20 14 is connected in a suitable manner to the channel system of the constructional part 1. Besides this, it will not be explained in further detail how air at temperatures for heating or cooling, or possibly thawing may be provided, since that is a condition which is outside the scope of the present invention. It shall only be mentioned briefly that used air may
25 be carried through a heat exchanger to take care of energy still left in the used air from the constructional part 1.

In certain building constructions the need for heating or cooling will suggest that only parts of the partition between
30 storeys are provided with the present constructional part 1.

Part of the partition between the storeys may then, as shown in Fig. 3, be replaced by one or more intermediate parts 13 of a different configuration than the present constructional part 1. It is also given that the constructional part 1 may
5 be composed of segments of smaller parts. These will then have to be connected along the side edges in a suitable manner, so that there is formed a constructional part 1 of dimensions adjusted for the building or plant construction in question.

10 The roof of the buildings shown in Figs. 2 and 3 could without difficulty be kept completely and/or periodically free of snow and ice by the use of the present constructional part 1 in the storey partition forming the roofs of said buildings. The constructional part could also be used to keep, for exam-
15 ple, the road surface of a bridge construction free of snow and ice.

The heating or cooling, or the thawing of snow and ice, respectively, takes place through utilisation of the temperature difference between the air in the constructional part 1
20 and the rooms, the snow and the ice, respectively. The surface of the constructional part will then have, for example, either a higher or a lower temperature than that of the room. Besides, dependent on whether heating or cooling is to take place, the constructional part 1 will contribute to the room
25 temperature being changed to the desired level. It should be mentioned in particular that with the present invention the heating and the cooling can take place with a smaller temperature difference between the air supplied and the room, than what is common in traditional air plants, by walking on
30 a floor with either increased or reduced temperature.

CLAIMS

1. A device by a constructional part (1) preferably extending between supporting parts (10, 11, 12) of a building or plant construction, and preferably forming partition
5 between storeys, such as a floor or deck, characterized in that the constructional part (1) is self-supported, preferably of light-weight material and comprises a channel system which is arranged so that air may be supplied and/or extracted through the channel
10 system, so that the constructional part (1) provides heating and/or cooling of rooms in the building or plant construction, or thaws snow and ice lying on the constructional part, respectively, the constructional part (1) being made up of at least three interconnected layers
15 (2, 3, 4) of corrugated sheet material, the layers (2, 3, 4) being arranged at angles in such a way that corrugations in layers, one on top of the other, form a preferably right angle between themselves, so that there is formed a channel system of the corrugations of the
20 layers (2, 3, 4), and in which the intermediate layer (3) is formed with a number of holes (6) extending transversely to and preferably in one plane through the mid section of the layer (3), so that air at a temperature suitable for respectively heating and/or cooling,
25 and thawing, respectively, may be carried through the formed channel system in a controlled manner.
2. A device according to claim 1, characterized in that the layers (2, 3, 4) are connected to each other at contact points between corrugation valleys and
30 ridges by means of popping, welding, gluing, screwing or similar.

3. A device according to any one of the preceding claims,
c h a r a c t e r i z e d i n that the corrugations of
the upper layer (4) are filled with an additional cast
(5) of light-weight material of good thermal conducting
5 properties to a level at least at the height of the cor-
rugation ridges.

4. A device according to claim 3, c h a r a c t e r i z e d
i n that the corrugation wall is formed with embossings
(7) in that part of the layer (4) which is to be cast
10 in.

5. A device according to any one of the preceding claims,
c h a r a c t e r i z e d i n that air is supplied
and/or extracted from the constructional part (1)
through at least one channel (14) of the supporting
15 parts (10, 11, 12) of the building or plant construc-
tion.

6. A device according to any one of the preceding claims,
c h a r a c t e r i z e d i n that the constructional
part (1) has connecting means arranged along at least
20 one side edge, so that adjacent constructional parts (1)
or similar may be connected.

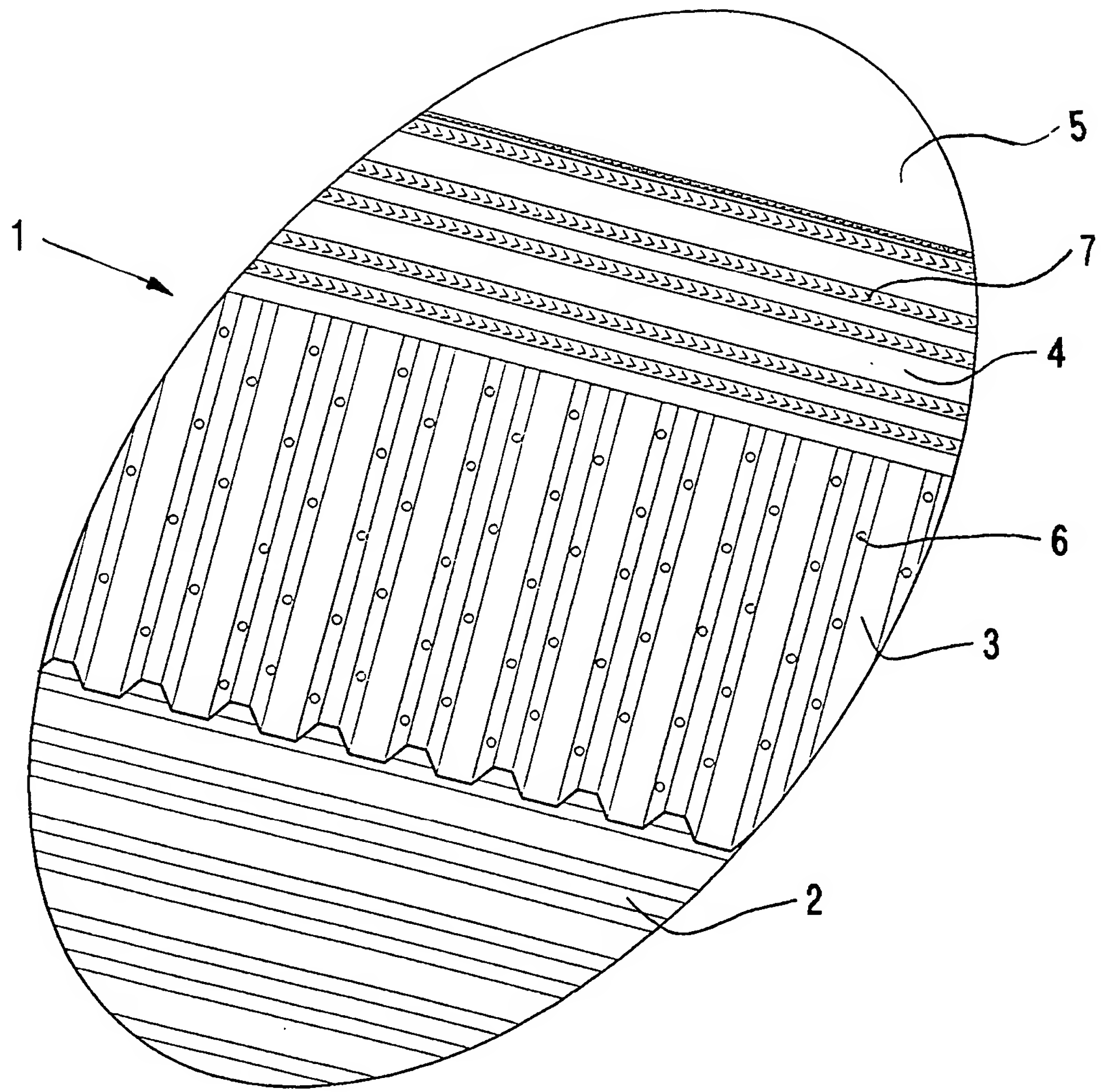


FIG. 1

2/3

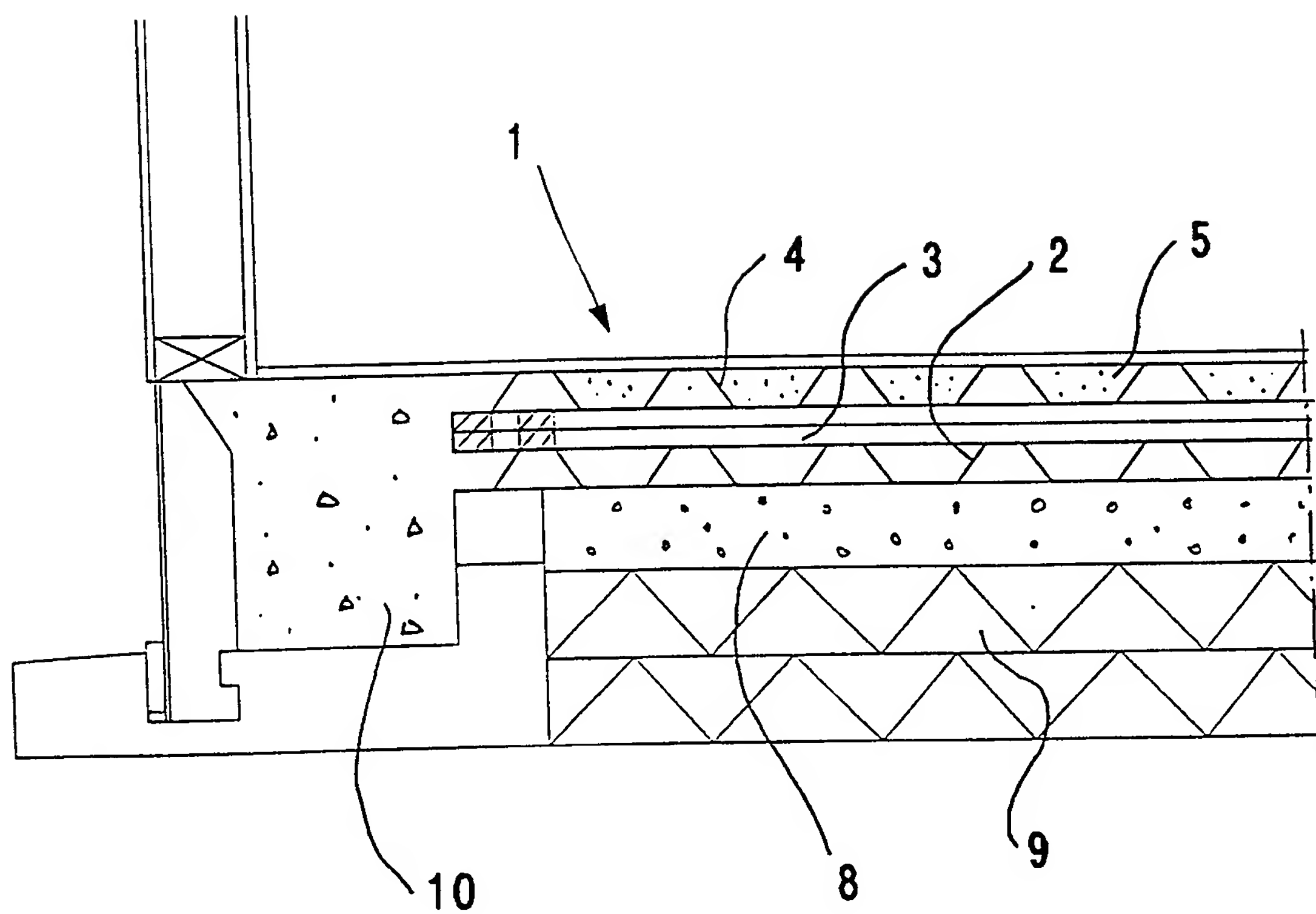


FIG. 2

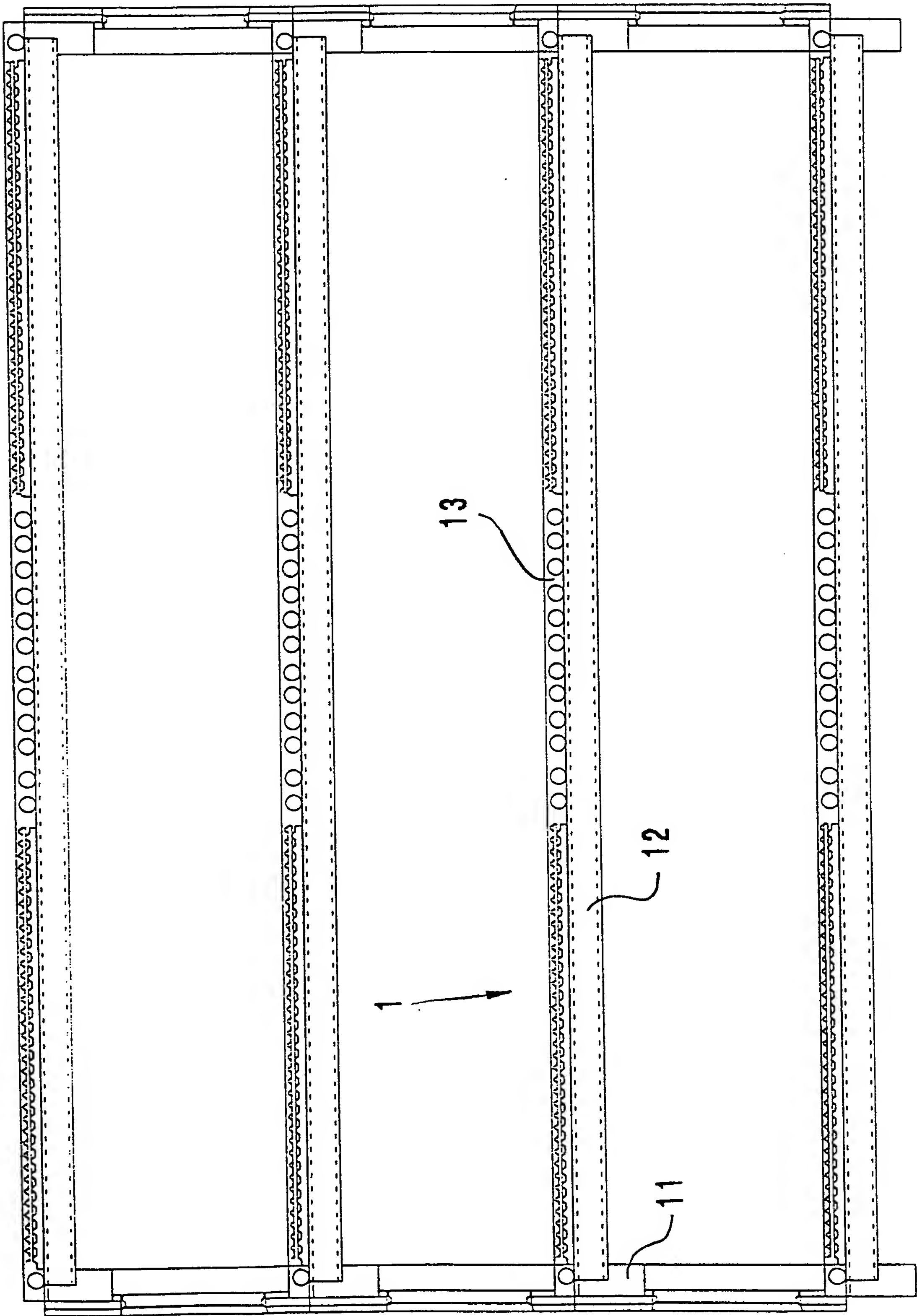


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO 99/00162

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: E04B 5/14, E04B 5/48, F24D 5/10 // E01C 13/02
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: E04B, F24D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, PAJ, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	SE 502251 C2 (LEGALETT SVENSKA AB), 25 Sept 1995 (25.09.95), page 3, line 2 - line 16; page 4, line 19 - page 6, line 8, figures 1,4,5 --	1-6
Y	WO 9500726 A1 (HUANG, CHIHSHU), 5 January 1995 (05.01.95), figure 1, abstract --	1-6
A	US 3802147 A (T.S. O'KONSKI), 9 April 1974 (09.04.74), figures 10-15 --	4
P,A	WO 9901619 A1 (VOLSTAD ENERGY AS), 14 January 1999 (14.01.99), page 4, line 19 - line 29; page 6, line 10 - page 7, line 16 --	1-6

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"I" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

9 November 1999

Date of mailing of the international search report

18 - 11 - 1999

Name and mailing address of the ISA/

Swedish Patent Office

Box 5055, S-102 42 STOCKHOLM

Facsimile No. +46 8 666 02 86

Authorized officer

Cecilia Bergold / MR

Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO 99/00162

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2294890 A (J.M. BRINKER), 8 Sept 1942 (08.09.42), figure 9 -- -----	1-6

INTERNATIONAL SEARCH REPORT

Information on patent family members

28/09/99

International application No.

PCT/NO 99/00162

Patent document cited in search report			Publication date	Patent family member(s)			Publication date
SE	502251	C2	25/09/95	AU	6727190	A	13/06/91
				CA	2073039	A	09/05/91
				EP	0506678	A	07/10/92
				SE	9002941	A	15/03/92
				WO	9107557	A	30/05/91

WO	9500726	A1	05/01/95	AU	681679	B	04/09/97
				AU	7119694	A	17/01/95
				BR	9407341	A	08/10/96
				CN	1097035	A	04/01/95
				US	5765329	A	16/06/98

US	3802147	A	09/04/74	NONE			

WO	9901619	A1	14/01/99	AU	8753398	A	25/01/99
				NO	304415	B	14/12/98
				NO	973111	D	00/00/00

US	2294890	A	08/09/42	NONE			
